

REMARKS/ARGUMENTS

Claims 10 and 18 have been amended in a non-limiting fashion in order to improve readability. These amendments are supported by the specification and claims as filed. New Claim 19 is supported at specification page 2, lines 4-9. New Claims 20 and 21 are supported at specification page 2, lines 14-22. New Claim 22 is supported at specification page 5, lines 10-11. New Claim 23 repeats Claim 18, but is dependent upon new Claim 22. No new matter has been entered.

The present invention relates to the regeneration of a very particular spent catalyst – a catalyst that has become spent by being used in a hydrogenation reaction of acetylene present in a gas mixture consisting essentially of HCl, the HCl having been obtained from the pyrolysis of 1,2-dichloroethane. As explained at specification page 1, in the production of vinyl chloride monomer 1,2-dichloroethane is subjected to pyrolysis to form vinyl chloride monomer on the one hand, and HCl on the other. In the course of this pyrolysis a small amount of acetylene is also produced, but this acetylene is not easily separated from the HCl due to their very similar volatilities. If this HCl is recycled to the oxychlorination, the trace of acetylene present therein is also recycled, and it gives rise to worthless by-products which are detrimental to the overall profitability of the process.

One known method for removing the acetylene is by converting it into ethylene by hydrogenation in the presence of an appropriate catalyst. Once such catalyst is described in DE 24 38 153, a reference cited against the present claims in an obviousness rejection in combination with Welty (U.S. 2,368,507).

DE '153 is described in detail at specification page 1, lines 20 ff, as is the difficulty in regenerating the particular spent catalyst at issue in this application. In addition, an article by Mueller is also cited there, at line 25 (this reference was included with the IDS of June 5, 2007). Both DE '153 and Mueller are publications of Degussa, the supplier of the catalyst

Applicant used in the example appearing in the present specification at page 5, lines 10ff.

Consistent with both DE '153 and Mueller, Applicant received a letter from Degussa concerning this catalyst, its inactivation through use, and its possible regeneration. This letter is attached hereto along with its English translation, and specifically notes at page 2 of the translation that "no catalyst regeneration [is] possible," recommending instead replacement with fresh catalyst.

Contrary to this, and as explained at specification page 1, lines 26ff, Applicant has found, surprisingly, that the regeneration of the particularly claimed spent hydrogenation catalysts herein can be accomplished by thermal treatment in the presence of oxygen, as claimed. This finding is completely surprising in view of the clear belief in the art, amounting essentially to a failure of others and/or long felt need, to regenerate such catalysts. The fact that thermal treatment has been used to regenerate other types of spent catalysts does not affect the patentability of the present invention, which is directed to the regeneration of catalysts that have become spent by being used in a hydrogenation reaction of acetylene present in a gas mixture consisting essentially of HCl that has been obtained from the pyrolysis of 1,2-dichloroethane.

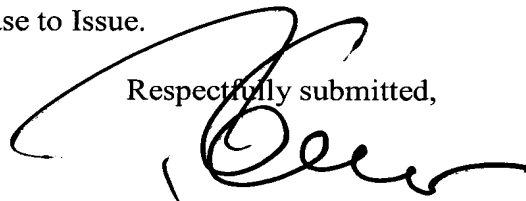
Welty does not discuss spent hydrogenation catalysts as claimed herein but, instead, relates to catalysts used in cracking, reforming, dehydrogenation, aromatization, and the like. See column 1, lines 1-7 of Welty. Thus, the Welty catalysts, when spent, are not those of the present claims or those of DE '153. Because the catalysts of the present invention and DE '153 are used in a different reactive environment, and for a completely different reaction (hydrogenation), as compared with the Welty catalysts, the materials and conditions responsible for the decrease in catalytic activity in Welty which must be reversed/removed in order to provide regeneration are completely distinct and different from those here and in DE '153.

Because the art clearly recognized the particular spent hydrogenation catalysts regenerated herein as unregenerable,<sup>1</sup> the fact that Applicant has succeeded in doing so is deserving of patent protection. Welty, drawn to the regeneration of very different spent catalysts, does not change this fact. As the Federal Circuit observed in *KSR International Co. v. Teleflex Inc.*, 82 USPQ2d 1385 (U.S. 2007), long felt but unsolved needs and the failure of others is an important factor to be weighed in favor of Applicant in the obvious determination:

“Graham v. John Deere Co. of Kansas City, 383 U.S. 1, 17–18, set out an objective analysis for applying §103: “[T]he scope and content of the prior art are ... determined; differences between the prior art and the claims at issue are ... ascertained; and the level of ordinary skill in the pertinent art resolved. Against this background the obviousness or nonobviousness of the subject matter is determined. *Such secondary considerations as commercial success, long felt but unsolved needs, failure of others, etc., might be utilized to give light to the circumstances surrounding the origin of the subject matter sought to be patented.*”” (emphasis added)

Accordingly, and in view of the clear teaching in the art regarding the supposed unregenerability of the particular spent hydrogenation catalysts being regenerated here, Applicant respectfully requests the reconsideration and withdrawal of the outstanding rejection, and the passage of this case to Issue.

Respectfully submitted,



---

Richard L. Treanor  
Attorney of Record  
Registration No. 36,379

Customer Number

22850

Tel: (703) 413-3000

Fax: (703) 413 -2220

(OSMMN 08/07)

<sup>1</sup> See the attached Declaration of Michel Strebelle.

FAX

Degussa-Hüls AG  
Sivanto  
Claus Bauer

To

To Solvin Kunststoffe GmbH  
Solvay Kunststoffe GmbH  
Mr Temath  
Rheinberg



47493 Rheinberg  
Germany

Department  
Telephone  
Fax

SV-IK-CK  
(069)218-2053  
(069)218-3392

To Fax 00492843-73-3744

Date 12.07.2000

Customer Ref. E39H / Assessment of used catalyst

Pages 3

Dear Mr Temath,

In reference to the inspection of your used E39H catalyst we have undertaken an assessment of this catalyst. This catalyst comes from our last delivery of 1992.

The following assessments were performed:

- 1) Visual assessment
- 2) Carbon deposits (quantitative C-assessment)
- 3) Semi-quantitative x-ray fluorescence analysis (XFA)
- 4) Laboratory performance test

- 1) Visual assessment:

The catalyst shows considerable deposits on the upper surface (carbon deposits). These deposits cannot be removed through simple sieving procedures or washing measures.

- 2) Quantitative C-determination

Fresh catalyst: 0 weight% C  
E 39 H Solvin: 0.7% (+/- 0.05) weight% C  
High proportion of carbon deposits

- 3) Semi-quantitative XFA

The values reflect orders of magnitude of the element contents. Depending on the matrix influence significant deviations could occur.

| Elements                         | Fresh E 39 H catalyst | Used Solvin catalyst |
|----------------------------------|-----------------------|----------------------|
| Pd (weight%)                     | 0.15                  | 0.14                 |
| Cl deposit (inorg.)<br>[weight%] | 0.015                 | 1.09                 |
| Fe [ppm]                         | < 50                  | 84                   |
| Traces                           | -                     | Co/Zn/Cu/Ti/Pb/Zr    |

Moderate increase in Fe load (Fe = catalyst poison)  
Cl deposits point to a high proportion of surface deposits.

#### 4) Laboratory performance test

GHSV: 20,000/hour  
Test gas: 99.3% nitrogen / 0.5% hydrogen / 0.2% acetylene  
Temp.: 100-190°C  
Detection: Acetylene conversion

| Reaction temperature [°C] | Minimum conversion fresh catalyst [%] | Conversion Solvin catalyst [%] |
|---------------------------|---------------------------------------|--------------------------------|
| 130° C                    | 60                                    | 6.5                            |
| 160° C                    | 70                                    | 10                             |

The used Solvin catalyst has very poor hydrogenating activity with regard to acetylene (see also evaluation graph in appendix).

#### Summary (assessment)

The Solvin catalyst that was inspected is a very inactive catalyst with a high level of carbon depositing on the surface. There is no unusual poisoning. Consequently the Solvin catalyst shows the signs of a catalyst which on the basis of its time in service has experienced a deactivation through surface deposits typical for this type of catalyst as a consequence of ageing. These surface deposits cannot be removed through simple washing or filtering procedures (no catalyst regeneration possible). The recommendation therefore is to replace the reactor charge with a fresh catalyst.

Yours sincerely,  
Degussa-Hüls AG

pp Claus Bauer  
Appendix

pp Stefan Bösing

E 39 H Activity Test  
Standard / Solving used 16.05.2000

Standard conversion  
Standard selectivity  
Solving used 16.05.2000 conversion  
Solving used 16.05.2000 selectivity

temperature [°C]

Degussa-Hüls

**FAX**

**Degussa-Hüls AG**

Sivento  
Claus Bauer

An Solvin Kunststoffe GmbH  
Solvay Kunststoffe GmbH  
Herr Temath  
Rheinberg



47493 Rheinberg  
Germany

Abteilung SV-IK-CK

Telefon (069) 218-2053  
Telefax (069) 218-3392

An Fax 00492843-73-3744

Datum 12.07.2000

Kd-Betroff E39H / Beurteilung von gebrauchtem Katalysator

Seiten 3

Sehr geehrter Herr Temath,

bezugnehmend auf die Bemusterung Ihres gebrauchten Katalysators E39H haben wir eine Bewertung dieses Katalysators vorgenommen. Dieser Katalysator entstammt unserer letzten Lieferung von 1992.

Folgende Beurteilungen wurden durchgeführt:

- 1) Visuelle Beurteilung
- 2) Kohlenstoff-Ablagerungen (Quantitative C-Bestimmung)
- 3) Semiquantitative Röntgenfluoreszenzanalytik (RFA)
- 4) Labor-Performancetest

1) Visuelle Beurteilung:

Der Katalysator weist beträchtliche Ablagerungen an der Oberfläche auf (Kohlenstoff-Ablagerungen). Diese Ablagerungen sind durch einfache Siebungsprozeduren oder Waschvorgänge nicht zu entfernen.

2) Quantitative C-Bestimmung

Fischer Katalysator: 0 Gew% C  
E 39 H Solvin: 0,7% (+/- 0,05) Gew% C  
Hoher Anteil an Kohlenstoffablagerungen!

3) Semiquantitative RFA

Die Werte spiegeln Größenordnungen der Elementgehalte wieder. Je nach Matrixeinfluß können beträchtliche Abweichungen auftreten.

| Elemente:                    | Frischer E 39 H Katalysator | Solvin Katalysator gebraucht |
|------------------------------|-----------------------------|------------------------------|
| Pd (Gew%)                    | 0,15                        | 0,14                         |
| Cl-Ablagerung (anorg) (Gew%) | 0,015                       | 1,09                         |
| Fe (ppm)                     | < 50                        | 84                           |
| Spuren                       | -                           | Co/Zn/Cu/Ti/Pb/Zr            |

Mäßige Erhöhung an Fe-Beladung (Fe= Katalysatorgift)  
Cl-Ablagerungen weisen auf einen hohen Oberflächenablagerungsanteil hin.

4) Labor Performancetest :

GHSV: 20.000/h  
Testgas: 99,3% Stickstoff / 0,5% Wasserstoff / 0,2% Acetylen  
Temp.: 100-190°C  
Erfassung: Acetylenumsatz

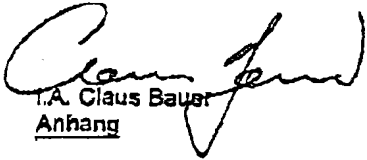
| Temperatur Reaktor [°C] | Mindestumsatz frischer Katalysator [%] | Umsatz Solvin Katalysator [%] |
|-------------------------|--|-------------------------------|
| 130°C                   | 50                                     | 6,5                           |
| 160°C                   | 70                                     | 10                            |

Der gebrauchte Katalysator von Solvin hat eine sehr geringe Hydrieraktivität bezüglich Acetylen (siehe auch Auswertungsgraph im Anhang).

Zusammenfassung (Bewertung)

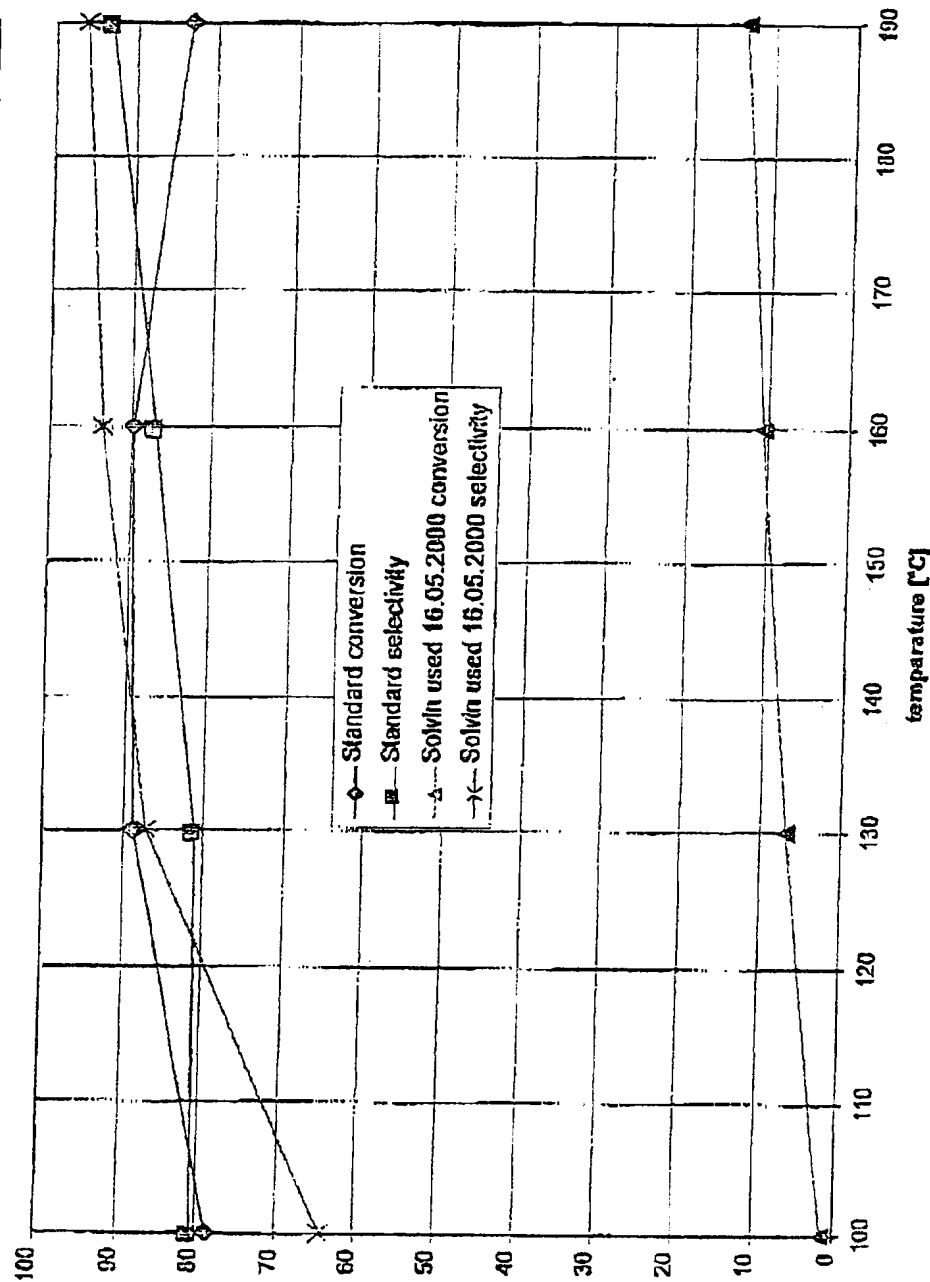
Der bemusterte Katalysator von Solvin ist ein sehr inaktiver Katalysator mit hohen Kohlenstoff-Ablagerungen an der Oberfläche. Eine außergewöhnliche Vergiftung liegt nicht vor. Somit zeigt der Solvin-Katalysator das Bild eines Katalysators der aufgrund seiner Einsatzzeit eine für diesen Katalysatortyp typische Deaktivierung infolge Alterung durch Oberflächenablagerungen erfuhr. Diese Oberflächenablagerung ist durch einfache Waschungen oder Siebungsprozeduren nicht zu entfernen (keine Katalysatorregenerierung möglich). Die Empfehlung ist deshalb ein Ersatz der Reaktorcharge durch Frischkatalysator.

Mit freundlichen Grüßen  
Degussa-Höls AG

  
i.A. Claus Bauer  
Anhang

  
i.A. Stefan Bösing

**E 38 H Activity-Test  
Standard / Solvin used 16.05.2000**



Degussa-Hüls